TTS-5

Memorandum

U.S. Department
of Transportation
**Federal Transit
Administration**

Subject: Information: 1991 National Rail Spare Ratio Study

Date: MAY 20 1994

From: Marvin Futrell
Marvin Futrell, Chief
Audit Review and Analysis Division

Reply to Attn. of: Branch x66694

To: Robert H. McManus, Associate
Administrator for Grants Management

Through: Marvin Futrell
for Edward R. Fleischman, Director
Office of Capital and Formula Assistance

The attached National Rail Spare Ratio Study has been prepared by Paul Branch. During FY 1993 Paul visited a number of rail agencies to discuss the factors which contributes to their spare ratio levels. This study examines the spare ratio levels of commuter and heavy rail transit systems nationally. The data used to develop this study are from the Section 15 Annual Report for the 1985 through 1991 report years.

Heavy rail agencies nationally lowered their operating spare ratios, between 1986 and 1991, from 45.6 to the 30 percent level. Commuter rail transit systems fluctuated between the 18 to 34 percent range. Overall, the larger heavy and commuter rail agencies are operating at lower spare ratio levels nationally. The smaller agencies are also lowering their spare ratio level over a seven year span.

Heavy rail and commuter rail systems unlike bus agencies are extremely individualized in the problems they encounter. Thus, the data varies among agencies within the same peer group.

ATTACHMENT:

CC: Executive Staff
Regional Administrators
Hiram J. Walker, TGM-2
Douglas A. Kerr, TGM-12
Kay Luongo, TGM-13

NATIONAL RAIL SPARE RATIO STUDY

FOR THE 1991 REPORT YEAR

OFFICE OF CAPITAL AND
FORMULA ASSISTANCE

AUDIT REVIEW AND ANALYSIS
DIVISION

NATIONAL RAIL SPARE RATIO STUDY

Office of Capital and Formula Assistance
Audit Review Analysis Division

Prepared By:
Paul R. Branch, Operations Research Analyst

1991 National Rail Spare Ratio Study

Executive Summary

This study examines the rail spare ratios for all heavy and commuter rail systems over a seven year-span, 1985 to 1991. In accordance with the Section 15 Glossary of Transit Terms, this study will reference Rapid Rail as **"Heavy Rail"**. The actual annual spare ratio percentages are appended. This study is stratified into two major sections for analysis purposes, they are current developments and systems size analysis. The current development analysis specifically examines Section 15 data for heavy and commuter rail systems for the 1991 report year. The system size analysis examines heavy and commuter rail systems according to systems size. Heavy rail systems are divided into three categories those agencies operating a Total Active Fleet **(TAF)** of over 500; 200 - 499 TAF; and under 200 TAF. Commuter rail systems unlike heavy rail operate less vehicles in maximum service nationally. Thus, commuter rail systems were divided into three categories that differ from the heavy rail categories, they are over 350 TAF; 100 - 350 TAF; and under 99 TAF.

CURRENT DEVELOPMENTS ANALYSIS

In 1991, 50 percent of the heavy rail agencies nationally operated at 35 percent spare ratio or less spare ratio. Seventy-five percent of the agencies operated at 55 percent or less, and 25 percent operated at 20 percent or less spare ratio. Additionally, 50 percent of the transit industry's commuter rail systems operated at the 20 percent level or less. Seventy-five percent operated at the 23 percent level or less and significantly 25 percent operated at less than 15 percent spare ratio in 1991.

SYSTEM SIZE ANALYSIS

Heavy rail systems with over 500 TAF operated at a seven year average of 30 percent, and has maintained an average spare ratio between the 26 to 33 percent range during the 1985 to 1991 report years. The agencies with 200 - 499 TAF have decreased their overall mean spare ratio from 45 percent in 1987 to 29 percent in 1991, with the exception of a slight 1 percent increase in 1989. The seven year mean for these agencies was 36.4 percent.

The smaller heavy rail systems with under 200 TAF, operated at higher spare ratios over the past seven report years than the larger agencies. These agencies operated at a seven year mean of 64.4 percent. However, since the 1985 report year smaller agencies have consistently reduced their average spare ratio annually, with the exception of a slight 6 percent increase, from 60 to 66 percent in the 1989 report year.

Commuter rail systems with over 350 TAF average spare ratios remained fairly constant under 19 percent between 1985 to 1991. These agencies operated at a seven year mean spare ratio of 16.4 percent. However, the actual spare ratios for agencies in this reporting group ranged from 3.8 to 27.8 percent over a seven year span.

The commuter rail agencies with 100 - 350 TAF mean spare ratio fluctuated at an average spare ratios between the 11 to 21 percent levels. These agencies decrease their mean spare ratio from

There is a wide range of spare ratio levels in this reporting group. The seven year mean spare ratio for this reporting group was 16.0 percent.

Commuter rail agencies with under 99 TAF operated at a seven year average of 57.1 percent. This reporting group's average spare ratio fluctuated annually over the past seven years from 68.7 percent to as low as 20.6 percent. These commuter rail systems' spare ratios are higher than larger commuter rail systems. Its important to note that all commuter system railcars are not the same. Many commuter rail systems operate one locomotive or motorized vehicle which pulls the other rail cars. However, there are some commuter rail agencies that operate railcars that are mechanically the same as heavy rail vehicles. These commuter rail agencies are likely to experience similar maintenance problems of heavy rail agencies, and have higher spare ratios.

Exhibit 1 displays the average (mean) spare ratio of all heavy and commuter rail systems over a seven year-span. Overall, heavy rail agencies nationally lowered their operating spare ratios. The heavy rail national average displayed in **Exhibit 1** indicates that between the 1986 report year and the 1991 report year the national average spare ratio for heavy rail systems decrease from 45.6 to 30.7 percent, with the exception of a slight increase of 5.2 percent in the 1989 report year.

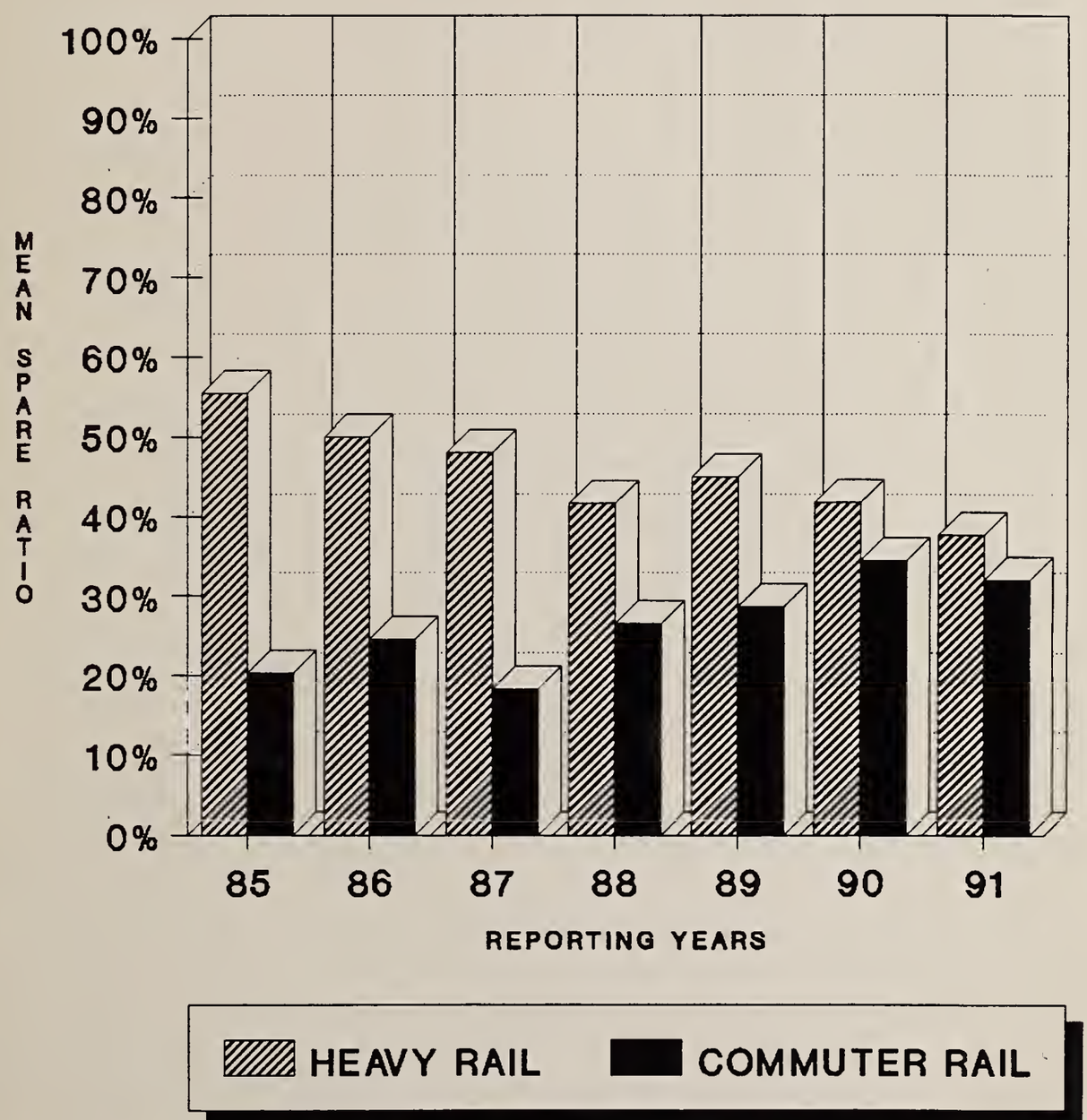
Commuter rail agencies nationally fluctuated between the 18.4 to 34.5 percent range. However, these agencies increased their national average spare ratio from 18.4 percent in 1987 to 34.5 percent in the 1990 report year, before a slight 2.4 percent decrease in 1991. The overall operating spare ratio of many of these agencies are lower than heavy rail systems. However, it is important to note that heavy rail vehicles have more frequent stops and longer peak periods, which increases unscheduled maintenance. Additionally, heavy rail systems are mechanically different from commuter rail systems, in that many heavy rail systems' railcars are tailored for only that system and in some case only one particular line within the heavy rail agency.

FACTORS THAT CONTRIBUTE TO NATIONAL RAIL SPARE LEVELS

Heavy and commuter rail systems unlike bus agencies are extremely individualized in the problems they encounter. For example, the newer agencies sometimes have problems achieving a lower spare ratio, because many times trains are purchased before stations and tracks are constructed, which is necessary due to the long acquisition period to obtain new rail vehicles. Additionally, the construction of the stations and tracks are often delayed. Consequently, new vehicles arrive and service is not yet ready to begin, which produces temporary and in some cases long term high spare ratios. Furthermore, many agencies operate trains that are manufactured and tailored for a specific rail system. Many rail transit agencies have trains and railcars that will operate on only one specific line within their system. Thus, the option of selling or disposing of unneeded trains or usage of trains from one line to the next to lower their operating spare ratio is not always an option.

Overhaul, scheduled and unscheduled maintenance programs have become a large problem in maintaining low spare ratios for systems nationally. In visiting a few of the nation's rail agencies, one concern is continuing regularly scheduled maintenance, while continuing to provide peak service with a reasonable headways.

EXHIBIT 1
NATIONAL MEAN SPARE RATIO BY SYSTEM TYPE
1985 - 1991



THE ABOVE PERCENTAGES REPRESENT THE AVERAGE (MEAN) FOR ALL HEAVY AND COMMUTER RAIL SYSTEMS NATIONALLY.

1991 National Rail Spare Ratio Study

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1991 NATIONAL RAIL SPARE RATIO STUDY

SCOPE

This study examines the spare ratios of commuter and heavy rail transit systems. Two separate analyses are used; system size; and a current development analysis. These analyses provide the Federal Transit Administration (FTA) with information to consider regarding the level of spare ratio of the rail transit industry, receiving Federal Section 9 and 3 Capital funds. This study gives the FTA an idea of the current, as well as the past spare ratio levels of commuter and heavy rail systems nationally.

The FTA does not have mandatory requirements, or national guidance on an acceptable operational spare ratio level for grantees. National instructions or a goal spare ratio level would be beneficial to the FTA due to the national audits of heavy rail spare ratios conducted by the OIG. Thus, this study is important to the development of national requirements, and the justification of guidance.

INTRODUCTION:

In accordance with the Section 15 ***Glossary of Transit Terms***[1], this study will reference Rapid Rail as "Heavy Rail". A commuter rail system is defined as a short-haul rail passenger service operating in metropolitan and suburban areas, whether within or across the geographical boundaries of a state, usually characterized by reduced fares, multiple rides, and commutation tickets and by morning and evening peak period operations.

The data used to develop this study were exacted from the Section 15 Annual report for a seven year-span, 1985 to 1991. This study contains all heavy and commuter rail systems in the Section 15 database. The rail data contained are examined in two sections; System Size Analysis; and Current Development Analysis. The System Size Analysis section is stratified into three reporting group; systems with over 500 Total Active Fleet (TAF); 200 - 499 TAF; and under 200 TAF. The commuter rail systems are also stratified into three reporting groups; over 350 TAF and 100-350 TAF; and under 99 TAF. The Current Development Section examines the 1991 data for all rapid and commuter rail agencies as a whole nationally.

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[1] Heavy Rail - Transit service using rail cars with motive capability, driven by electric power usually drawn from a third rail, configured for passenger traffic and operated on exclusive rights-of-way. Formerly Rail Rapid Transit.

The number of spare rail cars in a fleet is defined as the number of vehicles within a Total Active Fleet (TAF) not in use during the hours of maximum service operation. The number of Vehicles Operated in Maximum Service (VOMS) is defined as all vehicles operated during the peak hours of daily operation. The Total Active Fleet (TAF) is defined as all rail cars available for transit service at specific transit agencies. Thus, for the purpose of this study the spare ratio of a fleet of rail cars is calculated using the following equation:

$$\text{SPARE RATIO} = \frac{(\text{TAF})-(\text{VOMS})}{(\text{VOMS})}$$

This study contains graphical data and intends to answer the following questions:

- What are the 1991 spare ratio levels for heavy and commuter rail systems ?
- Over a seven year-span what has been spare ratio levels and what improvements have been made in general ?
- How does the size of fleet correlate with their spare ratio levels ?

This study is not intended to make comparison among heavy or commuter rail systems. Moreover, it's important to note that some high or low spare ratios may represent individual agency policies rather than inadequate or adequate management. Thus, this study intends to pinpoint the spare ratio of the rail industry in general. The analysis presented intends to support FTA officials in establishing future requirements and guidance.

CURRENT DEVELOPMENTS

In an effort to understand the current national spare ratio level of heavy rail and commuter rail systems nationally, this section will analyze the number of transit agencies that lie above or below a particular spare ratio percentage (i.e., 25, 35, etc..) specifically during the 1991 report year. The less-than cumulative frequency graphs **(Exhibits 2 and 3)** and distribution tables **(Tables 1 and 2 respectively)** displays this analysis.

HEAVY RAIL TRANSIT SYSTEMS

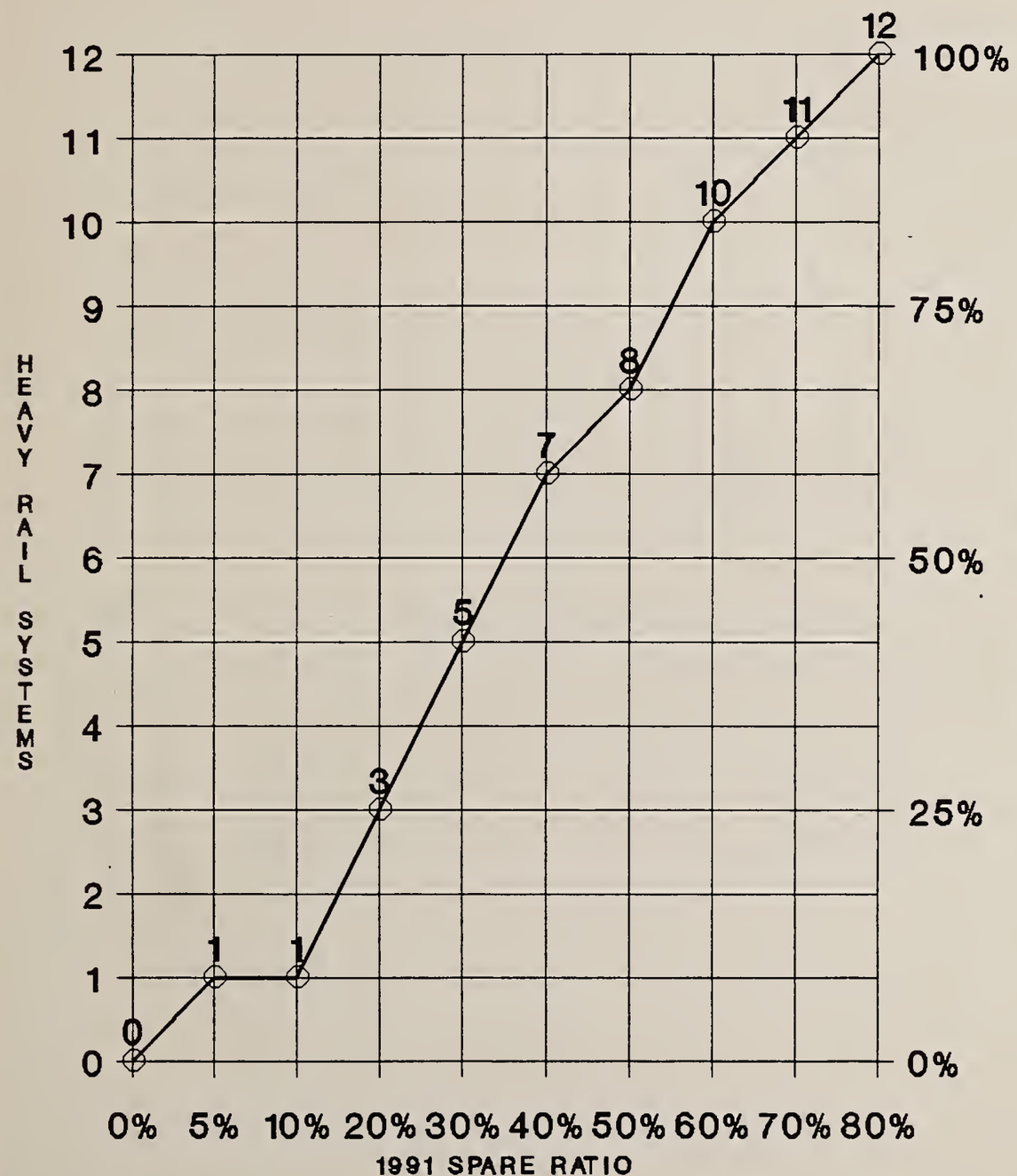
Exhibit 2 and (Table 1 - Appended) represent a distribution of heavy rail spare ratio percentages of the national transit industry reporting Section 15 data for the 1991 report year. This distribution includes all the heavy rail systems nationally. The following analysis was derived from **Exhibit 2**:

- Three agencies operated at 20 percent or less spare ratio, which accounts for 25 percent of the heavy rail transit systems nationally.
- Five agencies operated at 30 percent or less spare ratio, which accounts for 42 percent of the heavy rail systems nationally.
- Seven agencies operated at 40 percent or less spare ratio, which accounts for 58 percent of the heavy rail systems nationally.
- Eight agencies operated at 50 percent or less spare ratio, which accounts for 67 percent of the heavy rail systems nationally.
- Eleven agencies operated at 70 percent or less spare ratio, which account for 92 percent of the heavy rail systems nationally.
- Only, one agency operated a spare ratio greater than 70 percent.

Using the percentage of the total axis (Exhibit 2) 50 percent of the agencies operated at 35 percent spare ratio or less; 75 percent operated at 55 percent or less spare ratio; and only 25 percent operated at 20 percent or less spare ratio.

Overall, Exhibit 2 and (Table 1 - Appended) indicated that most heavy rail systems nationally operated at the 35 percent level during the 1991 report year.

EXHIBIT 2
HEAVY RAIL SPARE RATIO DISTRIBUTION FOR THE 1991 REPORT YEAR



NOTE -- the above graph represent a less than-cumulative frequency distribution for the 1991 report year.

COMMUTER RAIL TRANSIT SYSTEMS

Exhibit 3 and (Table 2 - Appended) displays a distribution of the commuter rail spare ratio percentages of the national transit industry for the 1991 report year. This exhibit and table indicated the following analysis:

- Five agencies operated at 15 percent or less spare ratio, which accounts for 42 percent of all commuter rail systems reporting Section 15 data in 1991.

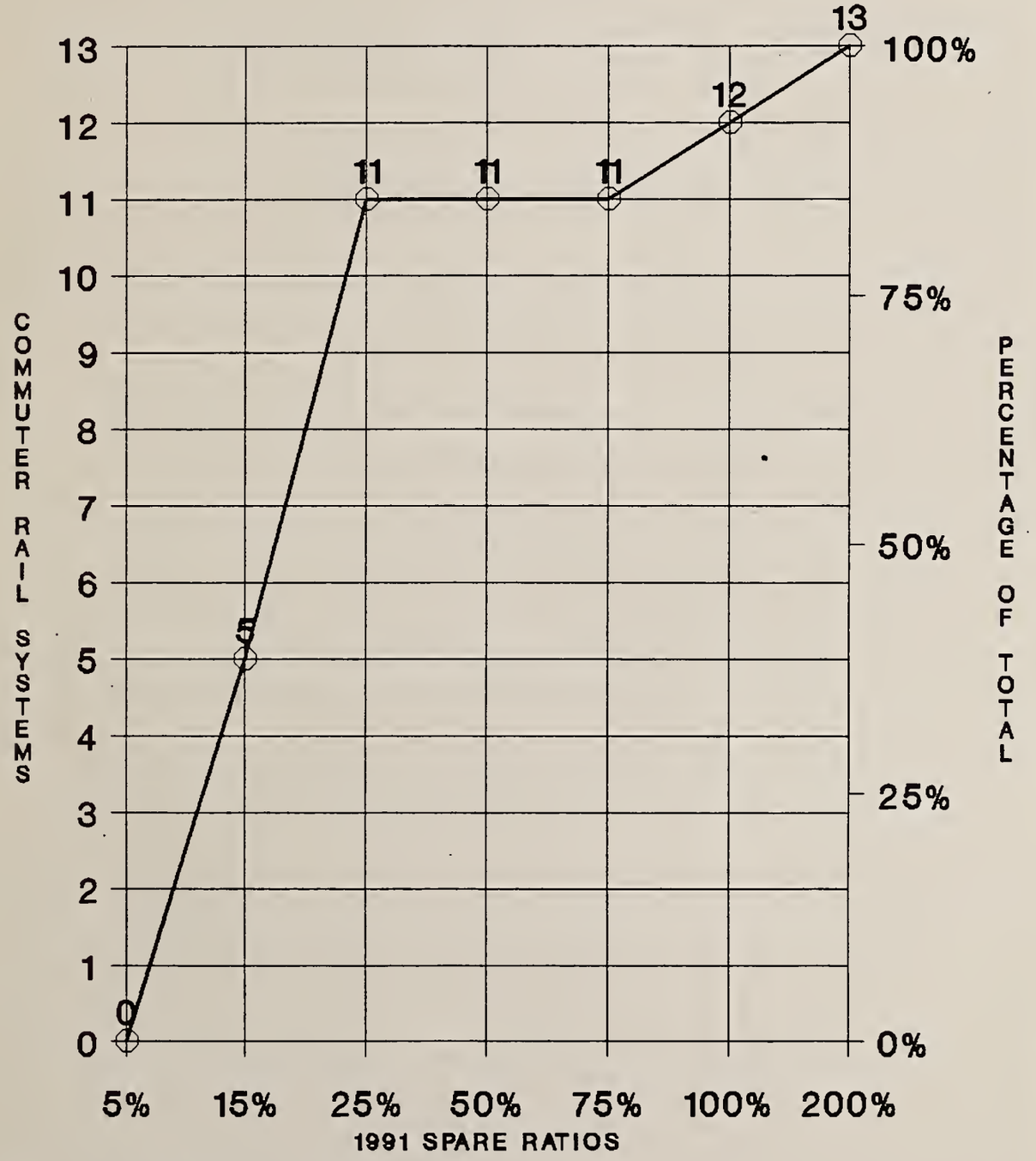
- Eleven agencies operated at 25 percent or less spare ratio. This accounted for 85 percent of the commuter rail systems nationally.

- Only two agencies operated at spare ratios greater than 75 percent, which accounts for 15 percent of the commuter rail systems nationally.

Using the percentage of the total axis **(Exhibit 3)**, 50 percent of the transit industry's commuter rail systems operated at around the 20 percent level or less; 75 percent operated at the 23 percent level or less; and significantly, 25 percent operated at less than 15 percent spare ratio in the 1991 report year.

Overall, the commuter rail systems nationally have done an extremely good job keeping their spare ratios low during 1991 report year. **Exhibit 3 and (Table 2 - Appended)** indicated that 50 percent of the commuter rail systems are operating at less than 25 percent spare ratio during the 1991 report year.

EXHIBIT 3
COMMUTER RAIL SPARE RATIO DISTRIBUTION FOR THE 1991 REPORT YEAR



NOTE -- the above graph represent a less than-cumulative frequency distribution.

TRANSIT SYSTEM SIZE ANALYSIS

In effort to understand the progress the transit industry has made towards improving spare ratio operational levels this section will examine spare ratio trend data stratified by the size of the transit system. Thus, for analysis purposes the reporting sizes of the nation's heavy rail systems are stratified into three reporting size groups, and analyzed over a seven year-span, 1985 to 1991. The heavy rail transit system groups are over 500 Total Active Fleet **(TAF)**; 200 - 499 TAF; and under 200 TAF. The commuter rail transit systems are stratified into three groups also which are; over 350 TAF; 100 - 350 TAF; and under 99 TAF.

HEAVY RAIL TRANSIT SYSTEMS

OVER 500 TOTAL ACTIVE FLEET

Exhibit 4 on the following page and (Table 3 Appended) displays the mean spare ratio of heavy rail transit systems operating a TAF of over 500 vehicles. The Section 15 data reported over a seven year span indicated the following analysis:

- Transit systems with over 500 TAF operated at a seven year mean of 30 percent.

- Transit systems with over 500 TAF have operated at a mean spare ratio of 33 percent or less over a seven year-span, and has consistently remained under 26 percent the past 4 years.

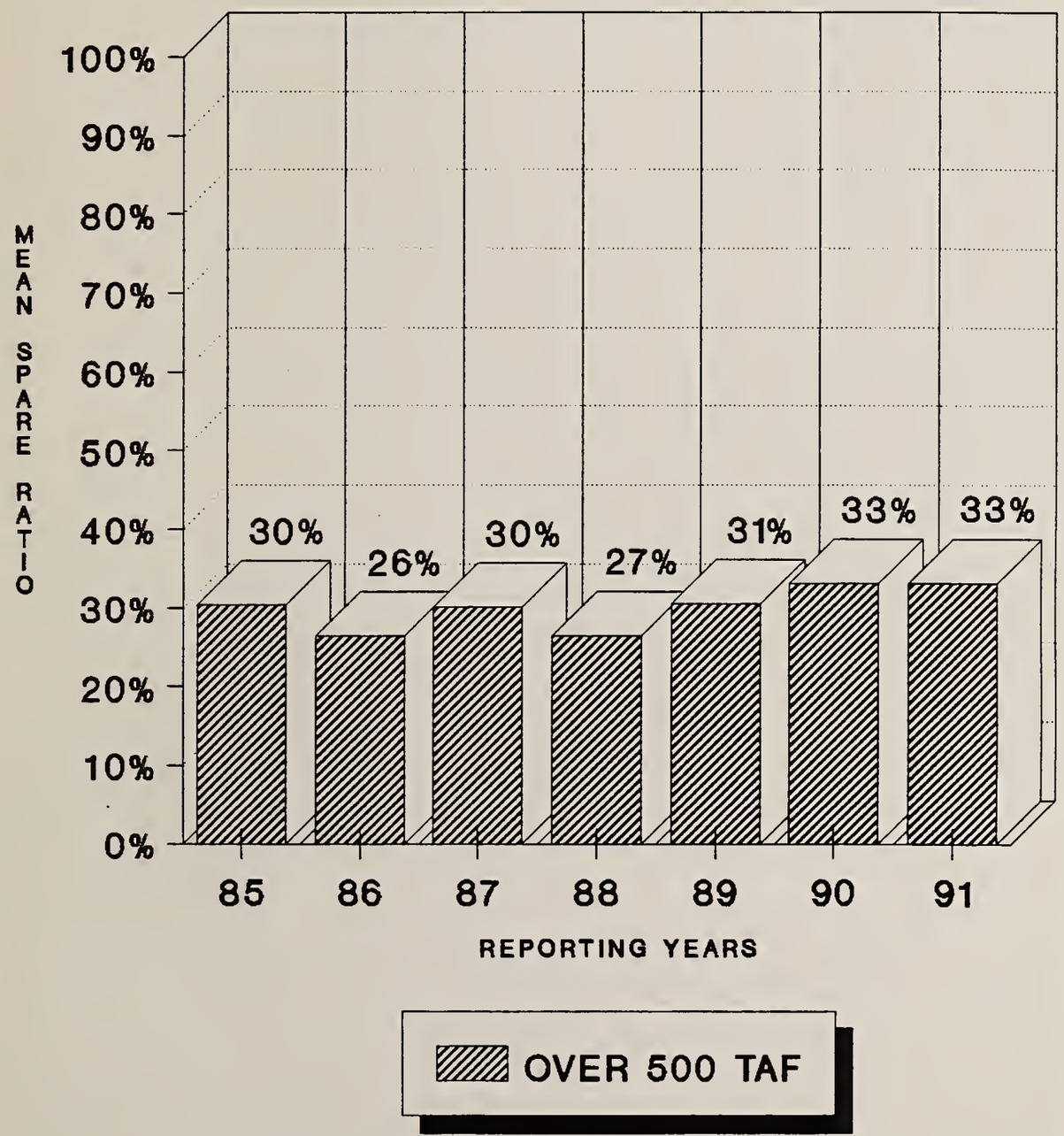
- Over a seven year span, the mean spare ratio for heavy rail transit system operating over 500 TAF has increased 10 percent.

- In the 1986 report year this group achieved its lowest mean spare ratio over a seven year span, which was 26.4 percent.

- This system size group over a seven year span have consistently achieved a lower mean spare ratio than the national mean.

- Seventy-five percent of the transit systems operating over 500 TAF achieved seven year mean spare ratios of 32 percent or less.

EXHIBIT 4
HEAVY RAIL MEAN SPARE RATIO BY SYSTEM SIZE
1985 - 1991



Note -- (TAF) represents the Total Active Fleet.

200 - 499 TOTAL ACTIVE FLEET

Exhibit 5 on the following page and (Table 3 - Appended) displays the mean spare ratio of heavy rail transit systems operating a TAF of 200 - 499. The Section 15 data reported over a seven year-span, 1985 to 1991, indicated the following analysis:

- Between 1985 to 1991, transit systems with 200 - 499 TAF operated at a seven year mean of 36.4 percent.

- Transit systems with a 200-499 TAF have operated at a mean spare ratio of 45 percent or less over a seven year-span, and has consistently remained under 39 percent between 1988 to 1991.

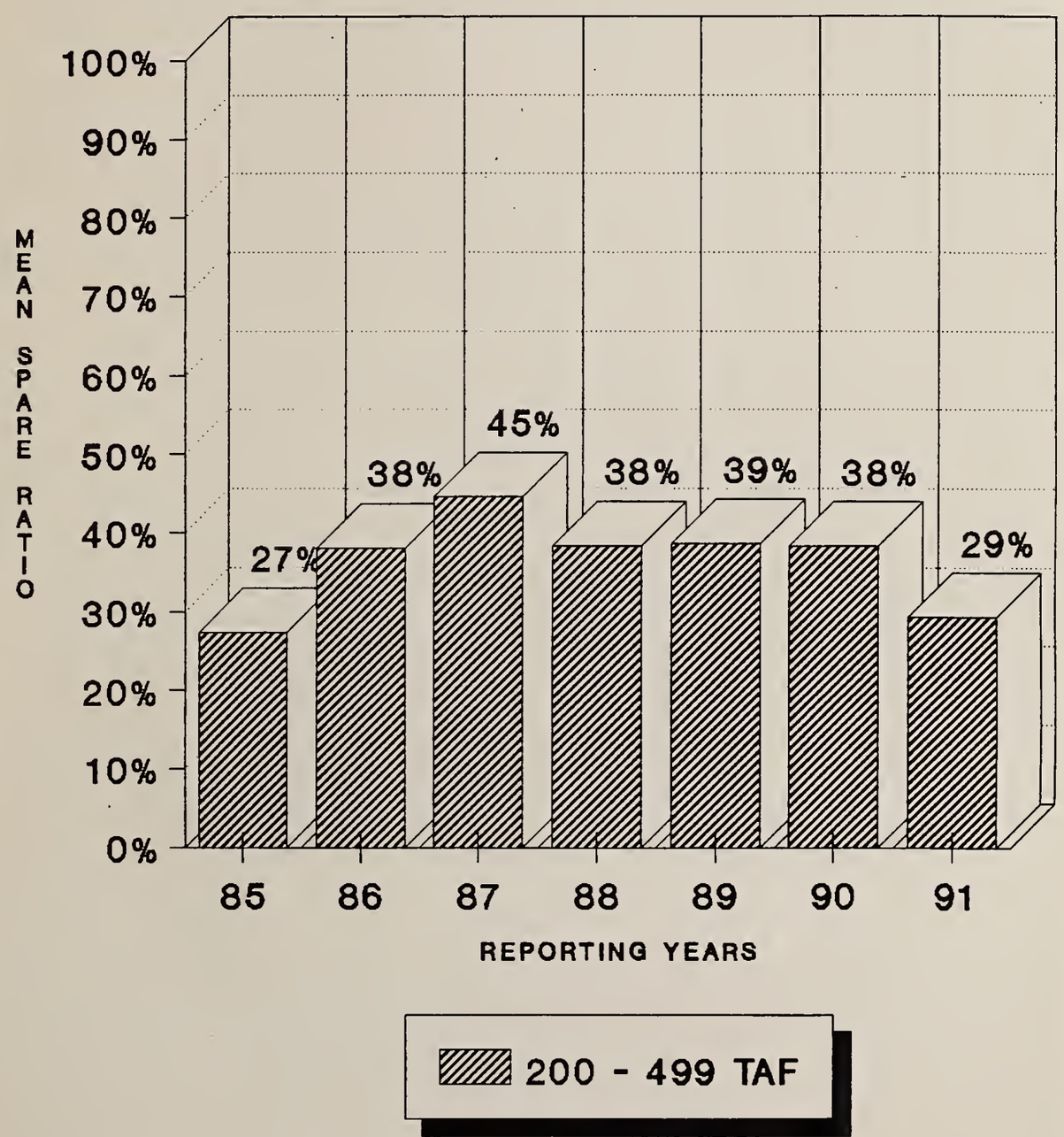
- Systems in this reporting group decreased their overall mean spare by 35.5 percent, with the exception of a slight increase of 2.63 percent in 1989.

- In the 1987 report year this group achieved its highest mean spare ratio, which was 44.6 percent, the lowest mean spare ratio was achieved in 1985, which was 27.4 percent.

- This group of heavy rail transit systems over a seven year span have consistently achieved a lower mean spare ratio than the national mean.

- Seventy-five percent of the heavy rail transit systems operating 200 - 499 TAF achieved a seven year mean of 32 percent or less.

EXHIBIT 5
HEAVY RAIL MEAN SPARE RATIO BY SYSTEM SIZE
1985 - 1991



Note -- (TAF) represents the Total Active Fleet.

UNDER 200 TOTAL ACTIVE FLEET

Exhibit 6 and (Table 3 - Appended) displays the mean spare ratio of heavy rail transit systems operating a TAF of under 200. This group of agencies over a seven year span indicated the following analysis:

- Transit systems with under 200 TAF operated at a mean spare ratio of 64.4 percent over a seven year-span.

- Since the 1985 report year this group of agencies decreased their mean spare ratio by 53.7 percent, from 108.4 percent to 50.3 percent with the exception of a 10 percent increase in 1989.

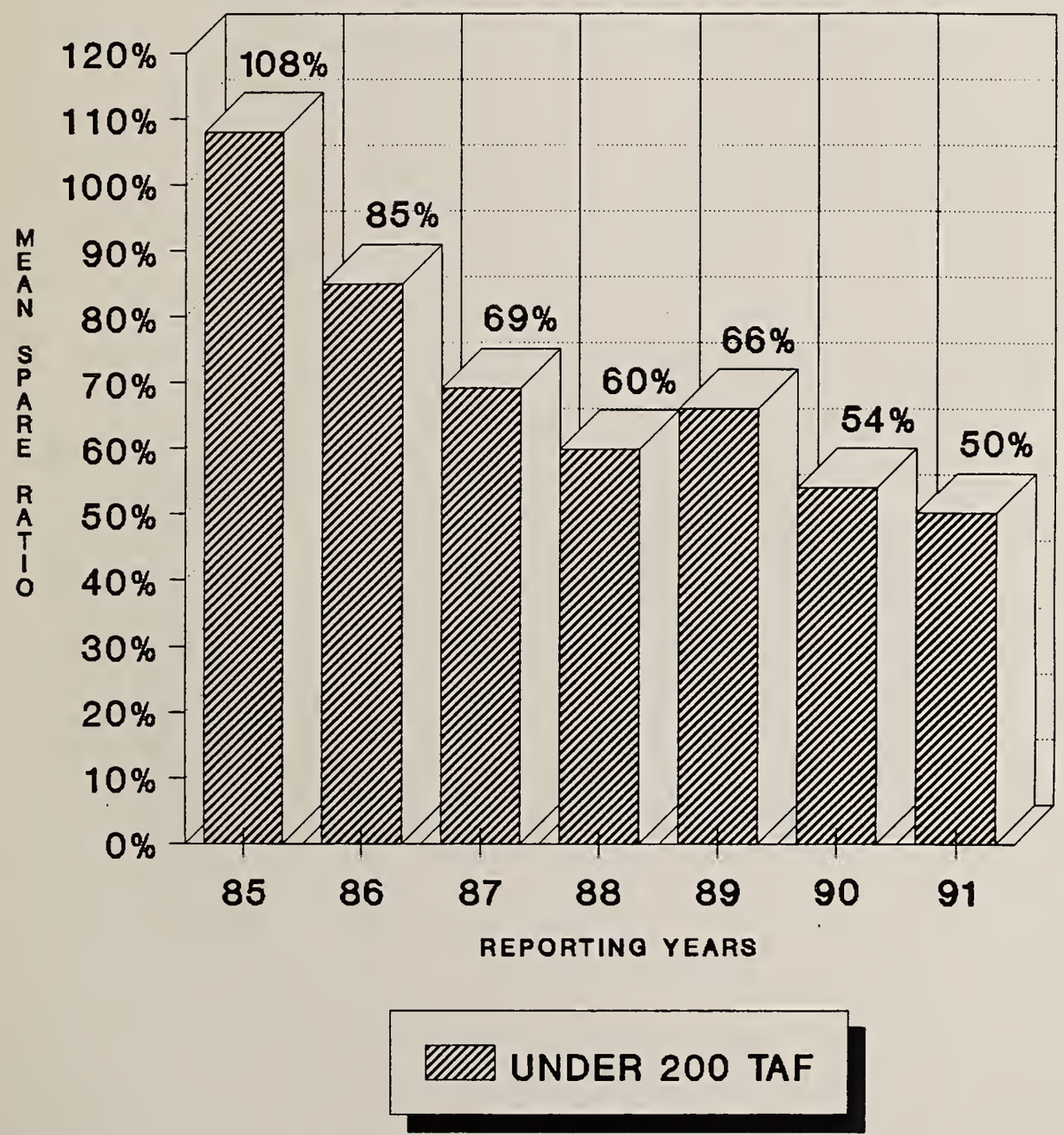
- Heavy rail transit systems with under 200 TAF over a seven year span have consistently operated at a higher mean spare than the national mean.

- In the 1985 report year this reporting group achieved its highest mean spare over a seven year span, which was 108.4 percent, and in 1991 this group achieved its lowest mean spare ratio over a seven year span, which was 50.3 percent.

- Fifty percent of the heavy rail transit systems with under 200 TAF achieved seven year mean spare ratios of 68 percent or less.

Overall, the larger systems have remained fairly constant at the 21 to 26 percent range. The systems with 200-499 TAF have fluctuate among the 22 to 39 percent range. The smaller agencies have operated at higher spare ratios, and have begun to lower their mean spare ratio over the past seven years.

EXHIBIT 6
HEAVY RAIL MEAN SPARE RATIO BY SYSTEM SIZE
1985 - 1991



Note -- (TAF) represents the Total Active Fleet.

COMMUTER RAIL TRANSIT SYSTEMS

OVER 350 TOTAL ACTIVE FLEET

Exhibit 7 and (Table 4 Appended) displays the mean spare ratio of commuter rail transit systems operating a TAF of over 350. The Section 15 data reported over a seven year span, 1985 to 1991 indicated the following analysis:

- Commuter rail transit systems with over 350 TAF operated at a seven year mean of 16.4 percent

- Commuter rail transit system with over 350 TAF operated at an annual mean spare ratio of 19 percent or less over a seven year-span, and has consistently remained under 16 percent the past 2 years.

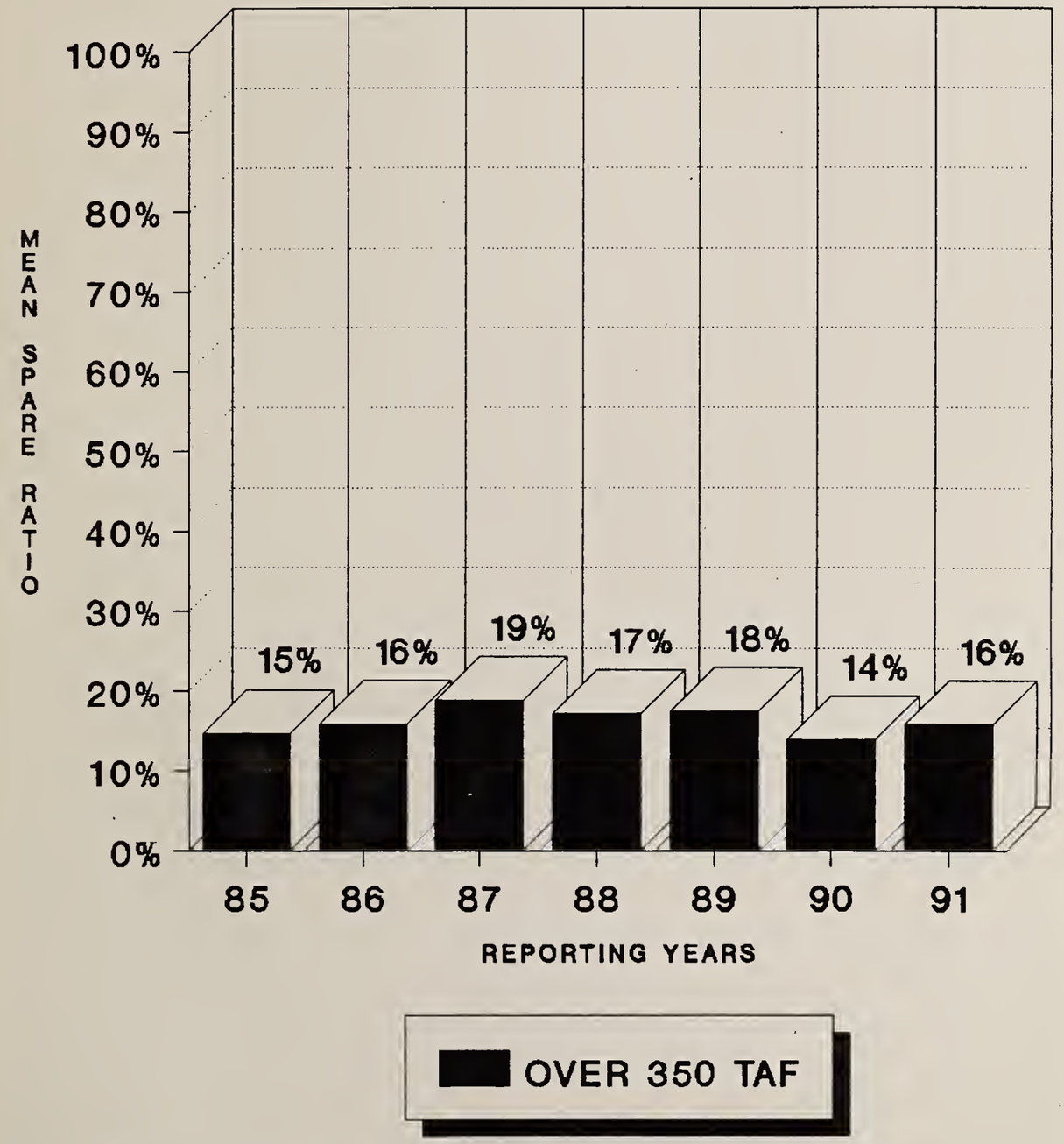
- Over a seven year-span, between 1985 to 1991, the mean spare ratio for commuter rail transit systems operating over 350 TAF 7.43 percent.

- In the 1990 report year this group achieved its lowest mean spare ratio over a seven year span, which was 14.0 percent.

- This commuter rail transit size group over a seven year span have consistently achieved a lower mean spare ratio then the national mean.

- Seventy-five percent of the commuter rail transit systems in this size group achieved seven year mean spare ratios of 18 percent or less.

EXHIBIT 7
COMMUTER RAIL MEAN SPARE RATIO
BY SYSTEM SIZE
1985 - 1991



Note -- (TAF) represents the Total Active Fleet.

100 - 350 TOTAL ACTIVE FLEET

EXHIBIT 8 on the following page and (TABLE 4 Appended) displays the mean spare ratio of commuter rail transit systems operating 100 - 350 TAF. The Section 15 data reported over a seven year span indicated the following analysis:

- The seven year mean for all Commuter rail transit systems operating a TAF of 100 - 350 TAF was 16.4 percent.

- Commuter rail transit systems with 100 - 350 TAF have operated at an annual mean spare ratio of 20.5 percent or less over a seven year span.

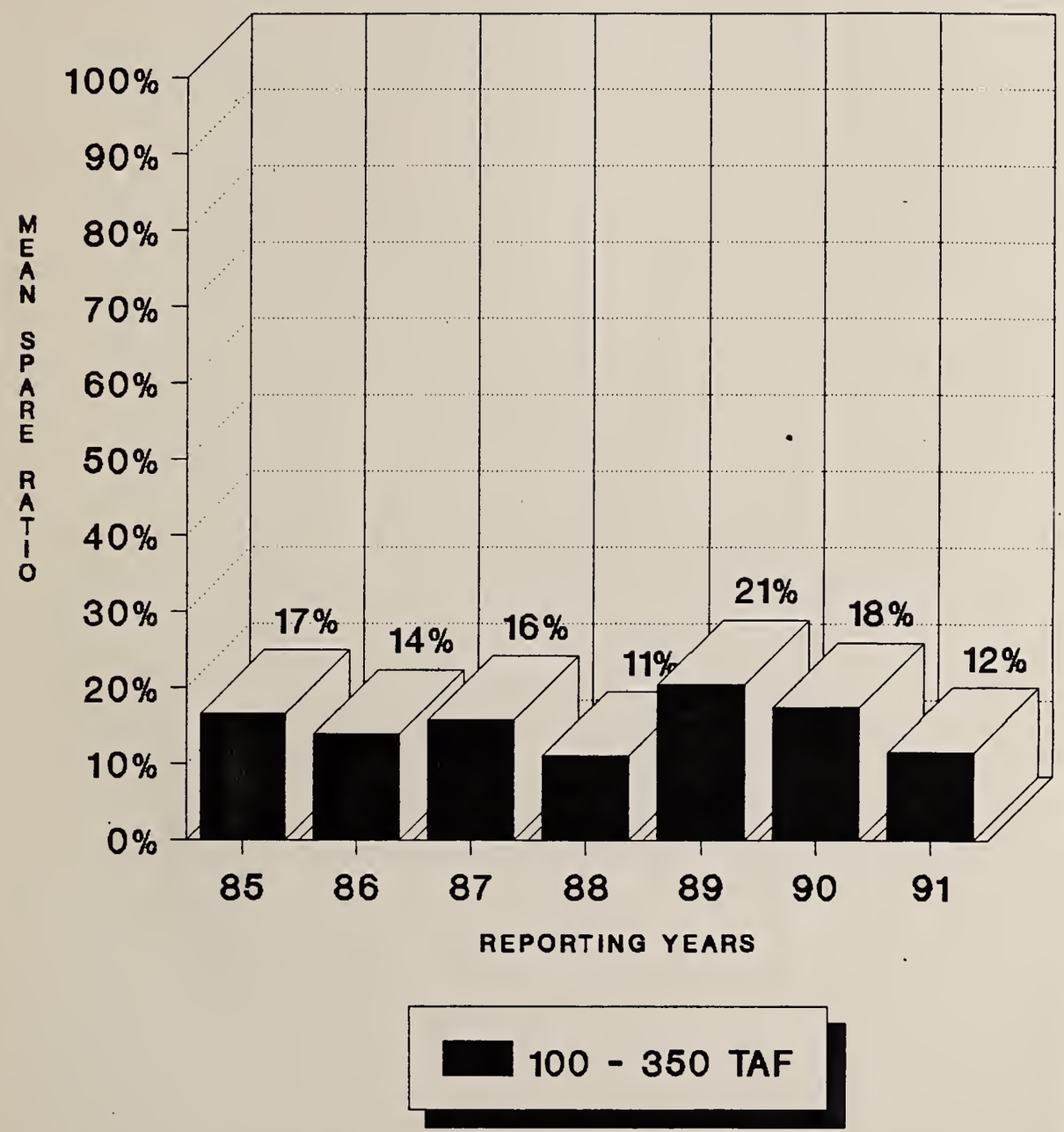
- Between 1985 to 1991, the annual mean spare ratio of commuter rail transit systems operating 100 - 350 TAF decreased by 30 percent.

- In the 1988 report year this group achieved its lowest mean spare ratio over a seven year span, which was 11 percent.

- This system size group over a seven year span have consistently achieved a lower mean spare ratio than the national mean of all commuter rail transit systems.

- Seventy-five percent of the transit systems operating 100 - 350 TAF achieved seven year mean spare ratios of 21.8 percent or less.

EXHIBIT 8
COMMUTER RAIL MEAN SPARE RATIO BY SYSTEM SIZE
1985 - 1991



Note -- (TAF) represents the Total Active Fleet. Commuter rail data was not reported until the 1983 report year.

UNDER 99 TOTAL ACTIVE FLEET

EXHIBIT 9 on the following page and (TABLE 4 Appended) displays the mean spare ratio of commuter rail transit systems operating under 99 TAF. The Section 15 data reported over a seven year span, 1985 - 1991, indicated the following analysis:

- The seven year mean for all Commuter rail transit systems operating under 99 TAF was 57.1 percent.

- Commuter rail transit systems with under 99 TAF have operated at a annual mean spare ratio of 71.9 percent or less over a seven year span.

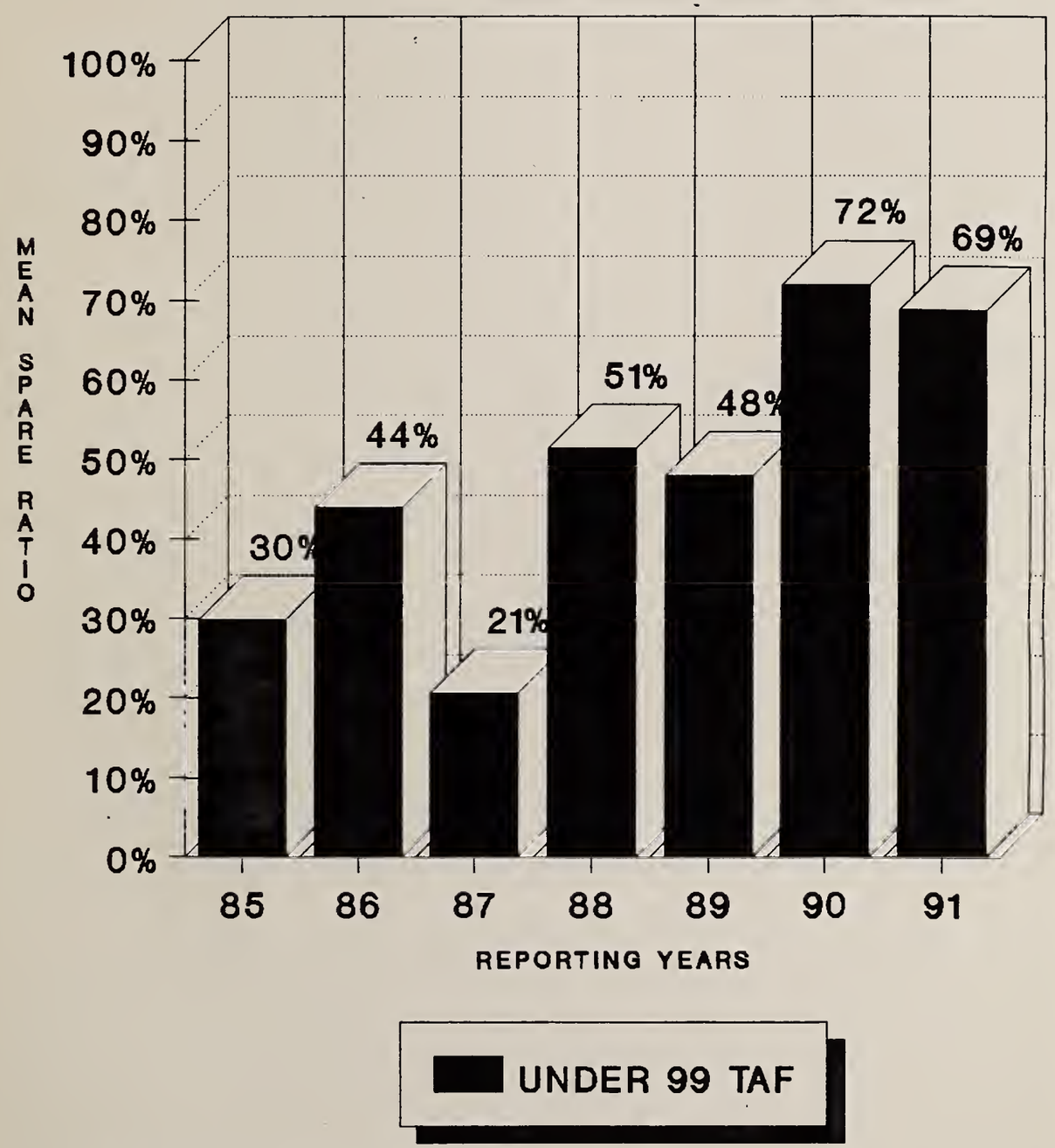
- Between 1985 to 1991, the annual mean spare ratio of commuter rail transit systems operating under 99 TAF increased 29.9 percent in 1985 to the 68 percent level in the 1991 report year.

- In the 1990 report year this group achieved its lowest mean spare ratio over a seven year span, which was 71.9 percent.

- Sixty percent of the commuter rail transit systems operating under 99 TAF achieved seven year mean spare ratios of 24.8 percent or less.

- This system size group over a seven year span have consistently operated at higher annual mean spare ratio than the commuter rail national mean.

EXHIBIT 9
COMMUTER RAIL MEAN SPARE RATIO
BY SYSTEM SIZE
1985 - 1991



Note -- (TAF) represents the Total Active Fleet.

CONCLUSION

Overall the larger heavy rail systems have operated at lower mean spare ratios over a seven year span. Heavy rail transit systems with over 500 Total Active Fleet (TAF) operated at a seven year average of 30 percent; systems with 200 - 499 TAF fluctuated at an range between 26 to 33 percent between the 1985 to 1991 report years; and the smaller heavy rail transit systems operated at a seven year mean of 70.3 percent. Its important to understand that heavy rail systems are very individualize in the problems they encounter. Many heavy rail transit systems operated trains that are tailored manufactured for the specific agencies making the acquisition. Additionally, heavy agencies often do not operated the same type of heavy rail vehicle throughout all lines providing service. For example, in visiting a few of the rail systems nationally its not uncommon to have one grantee with several types of heavy rail trains that will operate on only one line within that grantee's system. Thus, if unscheduled maintenance occurs, that agency could encounter a great deal of delays in service, as well as excess spares. Therefore, while a 30 or 40 percent spare ratio may appear high for certain agencies, its actually good considering the unscheduled, scheduled, and complexity of the heavy rail systems in general.

This study concludes that commuter rail systems have achieved lower spare ratios nationally as a whole, when examined by system size. The larger commuter rail transit systems with over 350 TAF average spare ratios have remained fairly constant under 19 percent between 1985 to 1991. The commuter rail transit systems operating 100 - 350 TAF mean spare ratio fluctuated yearly, with the exception of a slight decrease from 20.5 percent in 1989 to 11.6 percent in the 1991 report year. The very small commuter rail transit systems operating under 99 TAF have operated at a seven year mean spare ratio of 57.1 percent. Its important to note that most commuter rail transit systems on a hold do not require the level maintenance that heavy rail systems do on a regular basis. Additionally, most commuter rail transit systems operate only one locomotive which pulls the additional vehicles. Many commuter rail agencies' vehicles are not tailored manufactured to fit one agency system. Thus, the acquisition of railcars by other similar agencies is an option if Ridership decreases.

Overall, all the nation's rail systems as a whole have either begun to lower their spare ratio levels or fluctuated at very low spare ratios annually. Currently, 85 percent of the commuter rail systems nationally are operating at a spare ratio less than 25 percent and 58 percent of the heavy rail systems nationally operated at 30 percent or less spare ratio.

This study concludes that it would be difficult to access one spare ratio threshold for heavy rail and commuter rail transit systems. However, the FTA implement a range that is considered a goal level to not exceed. Additionally, its important to note that a national move towards producing heavy rail cars that are usable on more than one system nationally is a must. This guidance could began with new starts systems nationally, and continue with agencies requesting additional acquisitions or extending existing service.

NATIONAL RAIL SPARE RATIO STUDY APPENDIX

Office of Capital and Formula Assistance
Audit Review Analysis Division

NATIONAL RAIL SPARE RATIO STUDY
TABLE 1

LESS-THAN-CUMULATIVE FREQUENCY DISTRIBUTION

SPARE RATIOS	FREQUENCIES	CUM. FREQUENCIES
LESS THAN 5%	1	1
LESS THAN 10%	0	1
LESS THAN 20%	2	3
LESS THAN 30%	2	5
LESS THAN 40%	2	7
LESS THAN 50%	1	8
LESS THAN 60%	2	10
LESS THAN 70%	1	11
LESS THAN 80%	1	12
TOTAL OBSERVATIONS	12	

NOTE - THE ABOVE DISTRIBUTION REPRESENTS THE DATA DISPLAYED IN EXHIBIT 2.

NATIONAL RAIL SPARE RATIO STUDY
TABLE 2

LESS-THAN-CUMULATIVE FREQUENCY DISTRIBUTION

SPARE RATIOS	FREQUENCIES	CUM. FREQUENCIES
LESS THAN 15%	5	5
LESS THAN 25%	6	11
LESS THAN 50%	0	11
LESS THAN 75%	0	11
LESS THAN 100%	1	12
LESS THAN 200%	1	13
TOTAL OBSERVATIONS	13	

NOTE - THE ABOVE DISTRIBUTION REPRESENTS THE DATA DISPLAYED IN EXHIBIT 3.

NATIONAL RAIL SPARE RATIO STUDY
TABLE 3

HEAVY RAIL SYSTEMS BY SIZE

ID	ST			1985	1986	1987	1988	1989	1990	1991	SEVEN YEAR MEAN
		OVER 500 TAF									
5066	IL	CHICAGO-CTA	HR	30.9%	29.8%	36.5%	29.8%	31.9%	31.4%	30.4%	31.5%
2008	NY	NEW YORK CITY TA	HR	23.2%	25.5%	25.1%	21.9%	21.5%	15.9%	22.0%	22.2%
9003	CA	SAN FRANCISCO-BART	HR	36.4%	30.2%	30.2%	34.4%	53.2%	46.1%	48.7%	39.9%
3030	DC	WASHINGTON, D.C.-WMATA	HR	31.2%	20.2%	28.5%	20.1%	15.3%	38.9%	31.7%	26.6%
		MEAN SPARE RATIO		30.4%	26.4%	30.1%	26.5%	30.5%	33.1%	33.2%	30.0%
		200 - 499 TAF									
4022	GA	ATLANTA-MARTA	HR	35.1%	47.8%	82.6%	78.6%	69.8%	72.5%	72.7%	65.6%
2098	NY	NEW YORK-PATH	HR	19.9%	31.1%	33.6%	20.5%	26.6%	15.2%	15.2%	23.2%
3019	PA	PHILADELPHIA-SEPTA	HR	35.0%	34.6%	27.5%	29.5%	29.0%	39.5%	27.8%	31.8%
1003	MA	BOSTON-MBTA	HR	19.7%	38.9%	34.6%	25.0%	29.0%	26.3%	1.8%	25.0%
		MEAN SPARE RATIO		27.4%	38.1%	44.6%	38.4%	38.6%	38.3%	29.3%	36.4%
		UNDER 200 TAF									
3034	MD	BALTIMORE-MTA	HR	71.4%	71.4%	138.1%	66.7%	66.7%	66.7%	66.7%	71.4%
4034	FL	MIAMI-DADE CNTY TA	HR	50.0%	97.0%	75.7%	75.7%	91.4%	65.9%	58.1%	67.4%
2075	NJ	PORT AUTHORITY TC	HR	32.2%	34.4%	34.4%	34.4%	34.4%	26.0%	18.6%	30.0%
5015	OH	CLEVELAND RTA	HR	280.0%	137.1%	28.6%	62.9%	71.4%	57.9%	57.9%	88.9%
		MEAN SPARE RATIO		108.4%	85.0%	69.2%	59.9%	66.0%	54.1%	50.3%	64.4%
		NATIONAL AVERAGE		55.4%	49.9%	48.0%	41.6%	45.0%	41.8%	37.6%	

NOTE -- (TAF) represents the Total Active Fleet

RSRS7
24-Jan-94

NATIONAL RAIL SPARE RATIO STUDY
TABLE 4

COMMUTER RAIL SYSTEMS BY SIZE

			1985	1986	1987	1988	1989	1990	1991	SEVEN YEAR MEAN
	Over 350 TAF									
2100 NY	NEW YORK-LIRR	CR	11.5%	20.4%	18.2%	19.4%	19.5%	15.5%	21.6%	18.0%
2078 NY	NEW YORK-MTNR	CR	25.3%	22.8%	27.8%	22.1%	21.2%	16.1%	16.7%	21.6%
5118 IL	CHICAGO-COMMUTER RAIL BD	CR	4.7%	3.8%	9.1%	9.4%	10.7%	9.4%	8.4%	8.3%
2080 NJ	NEWARK-NJT CORP.	CR	17.6%	16.9%	20.4%	18.0%	18.4%	15.1%	17.0%	17.6%
	MEAN SPARE RATIO		14.8%	15.9%	18.9%	17.2%	17.5%	14.0%	15.9%	16.4%
	100 - 350 TAF									
3019 PA	PHILADELPHIA-SEPTA	CR	38.8%	35.7%	36.7%	31.8%	36.0%	28.6%	24.0%	32.9%
5122 IL	CHICAGO-BURLINGTON NORTH	CR	0.0%	0.0%	4.3%	5.6%	4.9%	7.7%	6.0%	3.9%
5121 IL	CHICAGO & NW TR CO	CR	4.3%	4.3%	6.4%	6.7%	4.5%	7.1%	4.6%	5.4%
1100 MA	BOSTON AMTRAK/MBTA	CR	22.8%	15.6%	15.6%	NR	36.7%	26.4%	11.6%	21.8%
	MEAN SPARE RATIO		16.5%	13.9%	15.7%	11.0%	20.5%	17.5%	11.6%	16.0%
	UNDER 99 TAF									
9075 CA	SAN FRANCISCO-CALTRANS	CR	0.0%	17.4%	32.8%	38.8%	38.8%	36.8%	19.7%	24.8%
5104 IN	N. INDIANA COMMUTER TD	CR	30.8%	17.9%	14.6%	14.6%	14.3%	14.3%	15.4%	17.3%
3046 MD	MARYLAND-MARC	CR	19.1%	11.8%	11.1%	31.6%	14.5%	8.6%	8.5%	14.8%
2099 NY	STATEN ISLAND RAPID TRANSIT	CR	44.4%	44.4%	44.4%	44.4%	44.4%	100.0%	100.0%	60.3%
9126 CA	CALTRAN CR LA	CR	266.7%	127.8%	NR	127.8%	127.8%	200.0%	200.0%	168.4%
	MEAN SPARE RATIO		29.9%	43.9%	20.6%	51.4%	48.0%	71.9%	68.7%	57.1%
	NATIONAL AVERAGE		20.4%	24.6%	18.4%	26.6%	28.7%	34.5%	32.1%	

NOTE -- (TAF) represents the Total Active Fleet

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